Quarterly Progress Report

July-September 1996

Mark R. Abbott
College of Oceanic and Atmospheric Sciences
Oregon State University

MODIS Team Member, Contract # NAS5-31360

Near-Term Objectives

- Revise the Algorithm Theoretical Basis Document (ATBD) and participate in panel review. The revised ATBD will include more detailed plans for validation as part of the overall EOS validation activity. We have also revised our CFE approach since the original ATBD, and we will also outline our results and approach for a new primary productivity data set. The latter will be a post-launch product.
- Develop quality assurance plan and quality flags for our data products. A first set will be delivered to Miami and compared with other products, especially where there are dependencies between FLH and CFE and other products.
- Contribute to and review the MOCEAN validation plan.
- Complete manuscript on bio-optical scales.
- Complete analysis of fluorescence quantum yields in the California Current. Compare with Southern Ocean results. Present results at SPIE Ocean Optics meeting.
- Combine CFE and FLH algorithms into single code. Incorporate in-line processing flags. Submit to Miami as Version 2 algorithm.
- Hire postdoctoral level person to serve as point of contact for MOCEAN and GLI activities. Deliver V1 code to GLI oceans team and begin to define integration issues.
- Continue to develop and expand browser-based information system for in situ bio-optical data.

Task Progress

1) ATBD

A revised version of our Algorithm Theoretical Basis Document (ATBD) was delivered to EOS Project Science Office in September. The ATBD contains a complete sensitivity analysis of the Fluorescence Line Height (FLH) algorithm using expected performance numbers for MODIS. The ATBD also describes our research into the

estimation of the quantum yield of fluorescence using FLH measurements. Such information will form the basis of future physiologically-based productivity models.

2) Data quality assurance plan

A complete description of the quality flags that will be generated during the production of FLH and CFE was delivered to Miami as part of the overall MOCEAN processing package. These flags will be used to guide the production process, including temporal and spatial binning. A brief description of the quality flags was also included in the ATBD.

3) MOCEAN validation plan

We provided input for the overall MOCEAN validation plan. Our activities will be based on drifter and mooring studies in the Southern Ocean in collaboration with Australian colleagues, nearshore studies in the productive coastal waters off Oregon, a bio-optical mooring in the oligotrophic central Pacific near Hawaii, and a planned MOCEAN cruise to the upwelling region off northwest Africa.

4) Bio-optical scales

We reanalyzed the Lagrangian scales of bio-optical variability as observed from drifters in the California Current. The results were nearly identical with those presented at the February 1996 Ocean Sciences meeting and described in an earlier MODIS report. One new result was the discovery that decorrelation time scales of fluorescence per unit chlorophyll were significantly smaller in the nearshore region than the equivalent scales of chlorophyll, while the two were nearly equal offshore. This supports the idea that fluorescence variability is high in productive, nutrient-rich waters nearshore whereas biomass and productivity are more in balance in the nutrient-poor offshore waters.

Three bio-optical drifters were deployed in the Southern Ocean as part of the JGOFS AESOPS. The drifters continue to relay data back to OSU.

5) Fluorescence quantum yields

Our analysis of fluorescence quantum yields based on bio-optical measurements in the Southern Ocean has been accepted for publication in *Geophysical Research Letters*. We attempted similar calculations for the California Current drifters. However, the number of Service Argos “hits” was too small to resolve the daily variations in quantum yield. We will continue this research with phytoplankton cultures using the Fast Repetition Rate fluorometer which is scheduled for delivery in spring 1997. Dr. Letelier participated in a cruise this past summer north of Hawaii. He is presently analyzing the data which revealed a large, unexpected bloom of diatoms. It appears that these diatoms contain nitrogen-fixing cyanobacteria, based on their optical properties. This subsurface bloom would not have been detectable by remote

sensing, and its impact on nitrogen flux may have been significant.

6) FLH and CFE algorithms

We are in the process of combining the CFE and FLH codes into one algorithm. This will form the basis of our Version 2 delivery to Miami.

7) GLI interactions

NASDA will provide partial funding for a postdoctoral-level researcher to interact with the MODIS Science Data Support Team, Miami, and the GLI team. The goal is to develop equivalent GLI oceans products using MODIS algorithms. I am requesting additional funds from the MODIS project to turn this into a full-time position.

8) Browser-based information system

Our development is following two lines: Java (Sun Microsystems) and ActiveX (Microsoft). The basic thrust is to build applets that can be used to query data bases (both NT and UNIX-based) as well as provide visualization and analysis capabilities. The goal is to make these platform-independent and to leverage off the enormous amount of off the shelf applications. For example, one ActiveX control is used to query the ocean drifter data base. It provides a simple track map of the drifter along with a coastline map. This object can then be dragged into a satellite image query ActiveX control which will then list all of the images that are coincident in time and space with the drifter track as well as provide an overlay. The track is a complete object so it can be dragged and dropped into any other OLE-compliant application. For example, the track might be dragged over an Excel spreadsheet. The data represented by the track then take on the appearance specified by the Excel container, in this case a spreadsheet. The user does not need to be concerned with format translations, etc. Concurrent development is being pursued with Java.

Anticipated Activities

1) Bio-Optical Mooring and Drifters

We will deploy our bio-optical mooring at the Hawaii Ocean Time-series site in November. The mooring will be serviced next May. The Southern Ocean drifter data will be analyzed this winter. We are also preparing for the bio-optical mooring experiment in the Southern Ocean scheduled for October 1997.

2) Laboratory Work

We are continuing the chemostat experiments on fluorescence quantum yield and primary productivity.

3) Information Management

We continue to develop Web-based browser and data analysis systems for the drifter data base and the satellite imagery data base.

4) Software

We will deliver an improved version of the FLH/CFE algorithm to Bob Evans at Miami. We will also hire a postdoctoral research to interface with the GLI team.

Problems/Corrective Actions

We are concerned about the pre-launch characterization of MODIS, which is critical to our standard data products.